EXP-63
July 24, 1974

ACCELERATOR EXPERIMENT: Transmission Versus Tunes in the Booster

Experimentalists: K. Meisner, F. Mills, A. Ruggiero

Date: July 11, 1974

The Booster was run with DC magnetic field set at the injection value. The RF was turned off. The sextupoles were set at the injection value (3A). The tunes were set with the trim quads, and measured by detecting the spontaneous coherent motion during the first ~ 100 μs after injection. The Linac was operating in the high intensity mode (~ 80 mA). Only one turn was injected in the Booster.

The results of the measurements are shown in the enclosed plots with a circled number at the right and top corner (from (2) to (15)). The quadrupole setting is shown on the horizontal axis. The first column is the fractional part of the tune (V vertical, H horizontal) and the second column the transmission defined as the ratio of the charge detected at two times t_1 and t_2. It was set t_1 = 1 ms and t_2 = 29 ms after injection, except in the plots (14) and (15) where t_1 = 0 ms and t_2 = 2 ms. The dashed lines in these plots give the tune, the other curves the transmission.

The other plots show the tunes plane (ν_y versus ν_x) with all the resonance lines up to and including fourth order. Each diagram refers to the data plots marked by the numbers (not circled) at the right and top corner. The working line where the transmissions were taken is the dashed line.

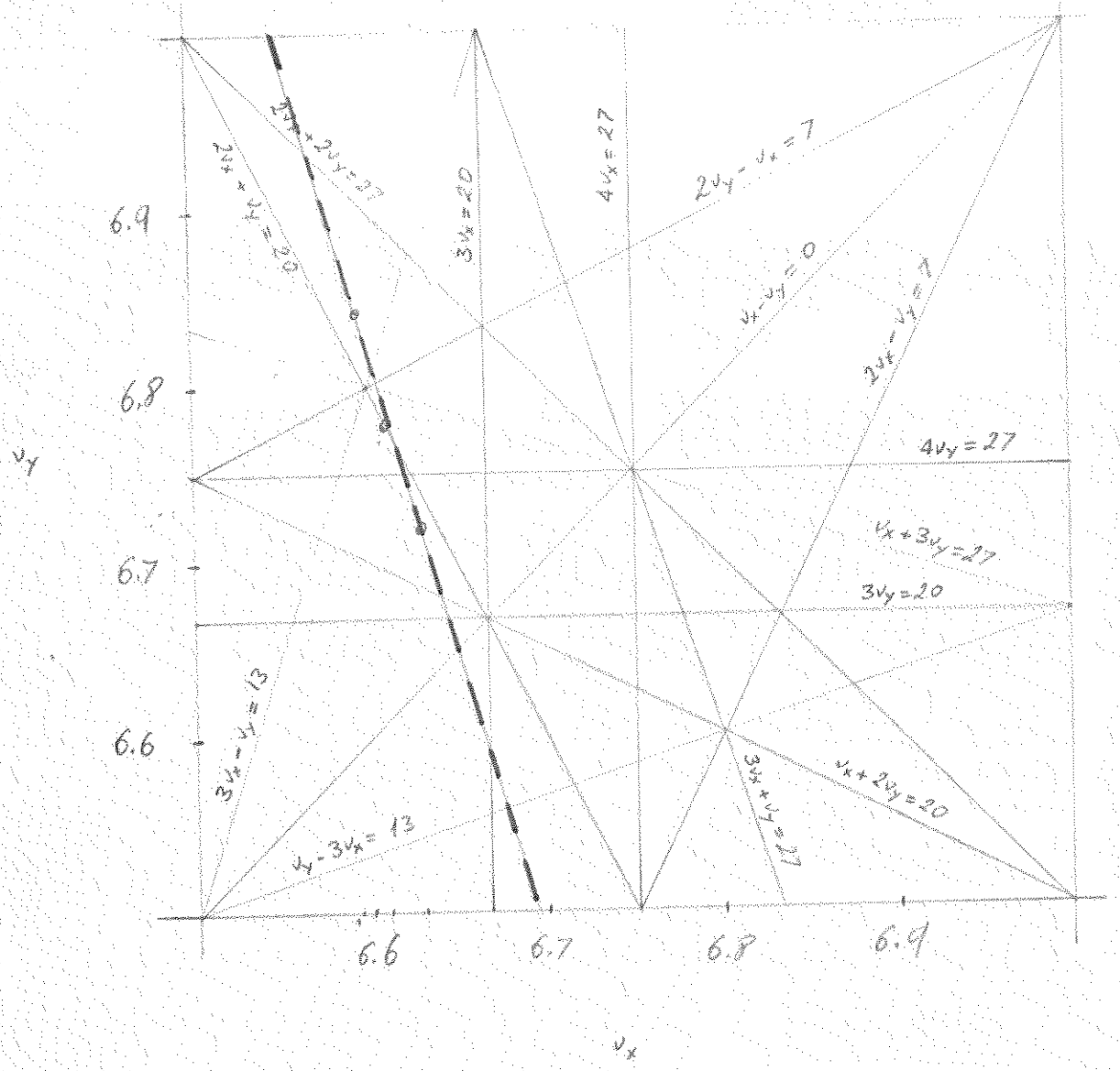
Plot (3) was taken with a vertical wire moved close to the beam.

We had no idea of the stability of the tunes during each pulse. Also we found that the beam decay was not always smooth but often broken by sudden steps.

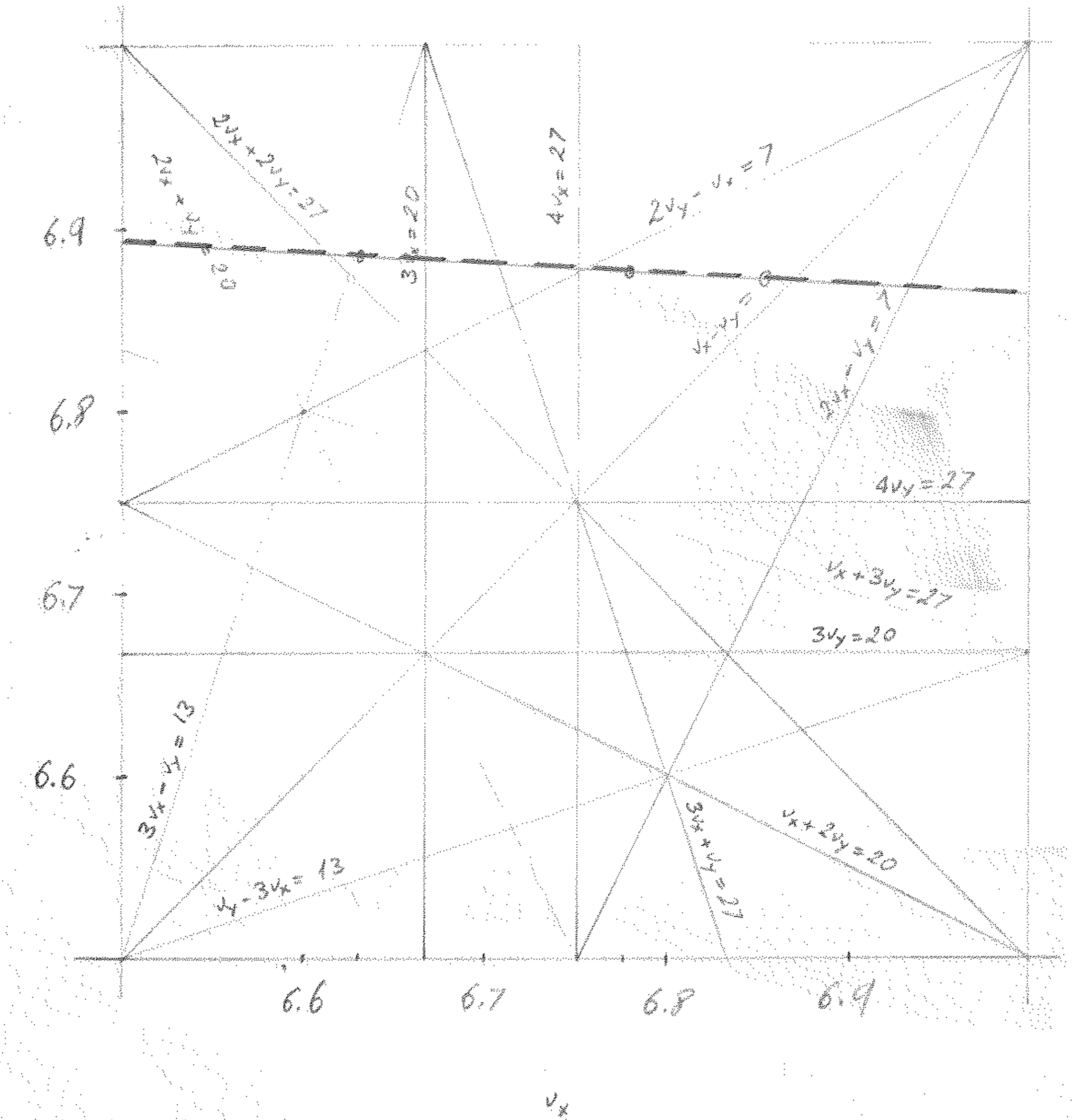
Inspection of the plots clearly denotes that all the resonances up to and including fourth order are more or less involved.

A.G. Ruggiero

2 and 3

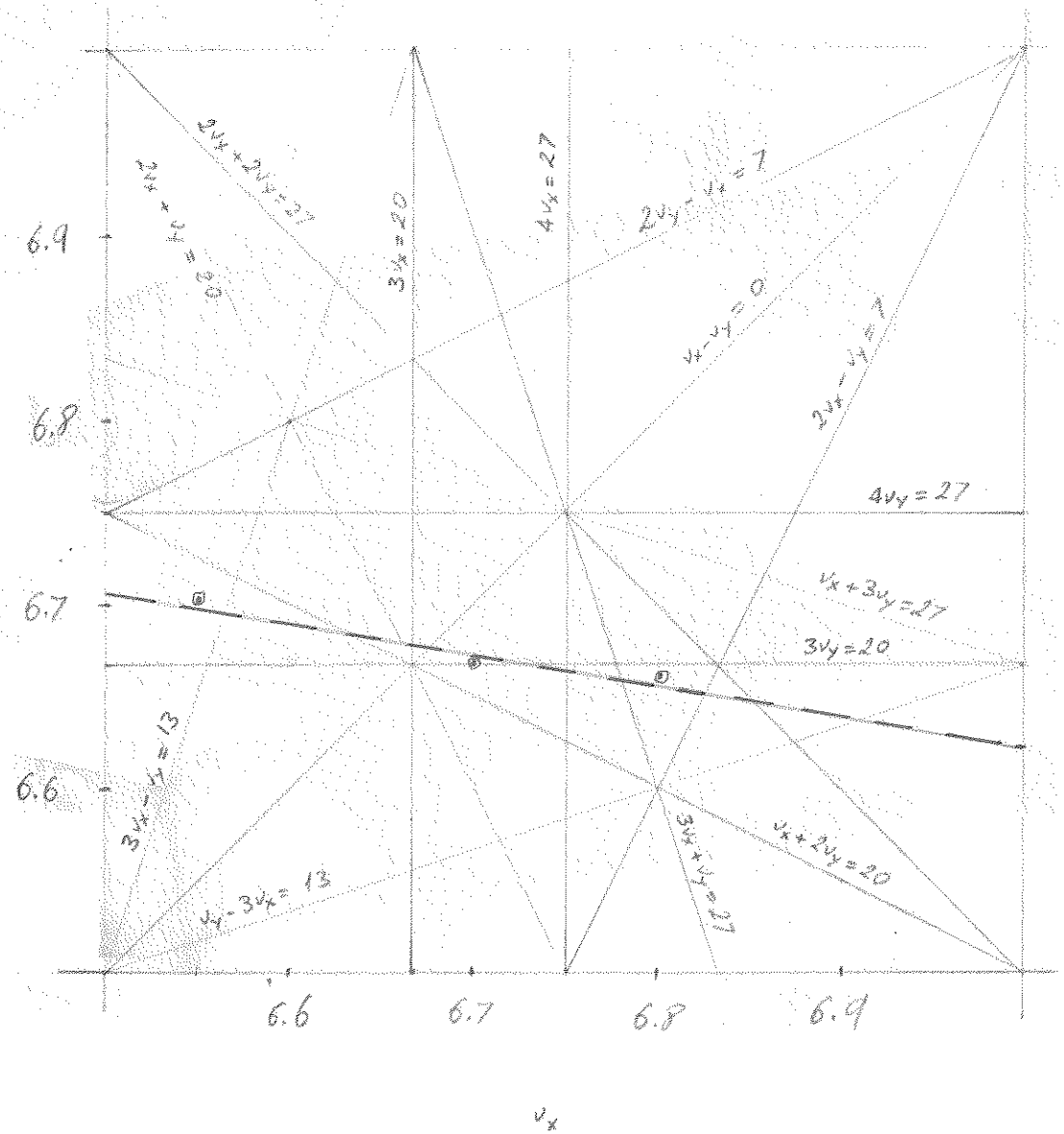

6.9
6.8
6.7
6.6
v_y
6.6
6.7
6.8
6.9
v_x
$4v_x = 27$
$3v_x = 20$
$2v_y - v_x = 7$
$v_x - v_y = 0$
$2v_x - v_y = 7$
$4v_y = 27$
$v_x + 3v_y = 27$
$3v_y = 20$
$3v_x - v_y = 13$
$v_y - 3v_x = 13$
$v_x + 2v_y = 20$
$3v_x + v_y = 27$

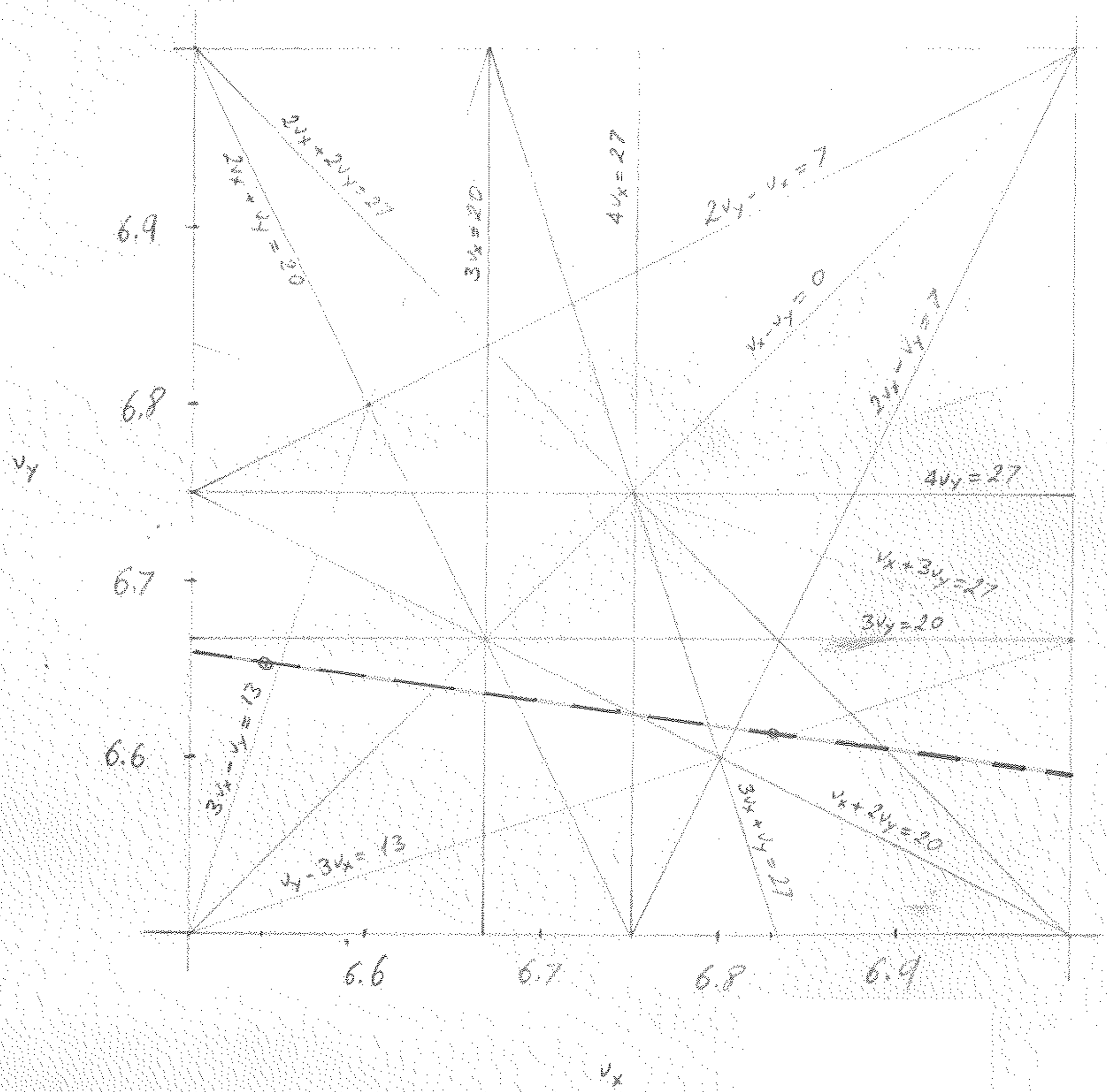
4 and 5



2vx + 2vy = 27
2vx + vy = 20
3vx = 20
4vx = 27
2vy - vx = 7
vx - vy = 0
2vx - vy = 7
4vy = 27
vx + 3vy = 27
3vy = 20
3vx - vy = 13
vy - 3vx = 13
3vx + vy = 27
vx + 2vy = 20
6.6
6.7
6.8
6.9
vy
vx

6 and 7


6.9
6.8
6.7
6.6
v_y
6.6
6.7
6.8
6.9
v_x
$2v_x + 2v_y = 27$
$v_x + v_y = 13$
$3v_x = 20$
$4v_x = 27$
$2v_y - v_x = 7$
$v_x - v_y = 0$
$2v_x - v_y = 7$
$4v_y = 27$
$v_x + 3v_y = 27$
$3v_y = 20$
$3v_x - v_y = 13$
$v_x - 3v_x = 13$
$3v_x + v_y = 27$
$v_x + 2v_y = 20$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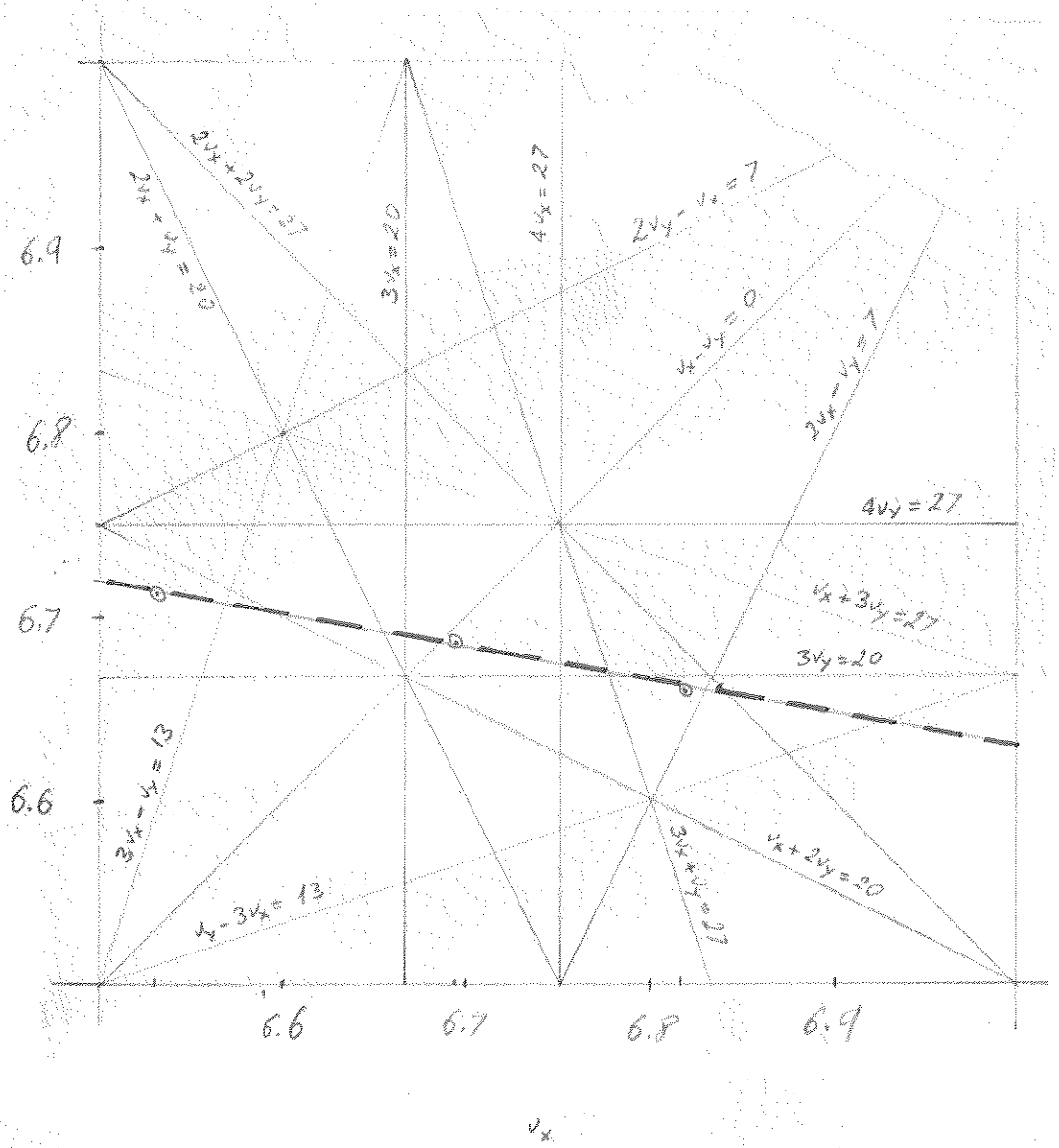
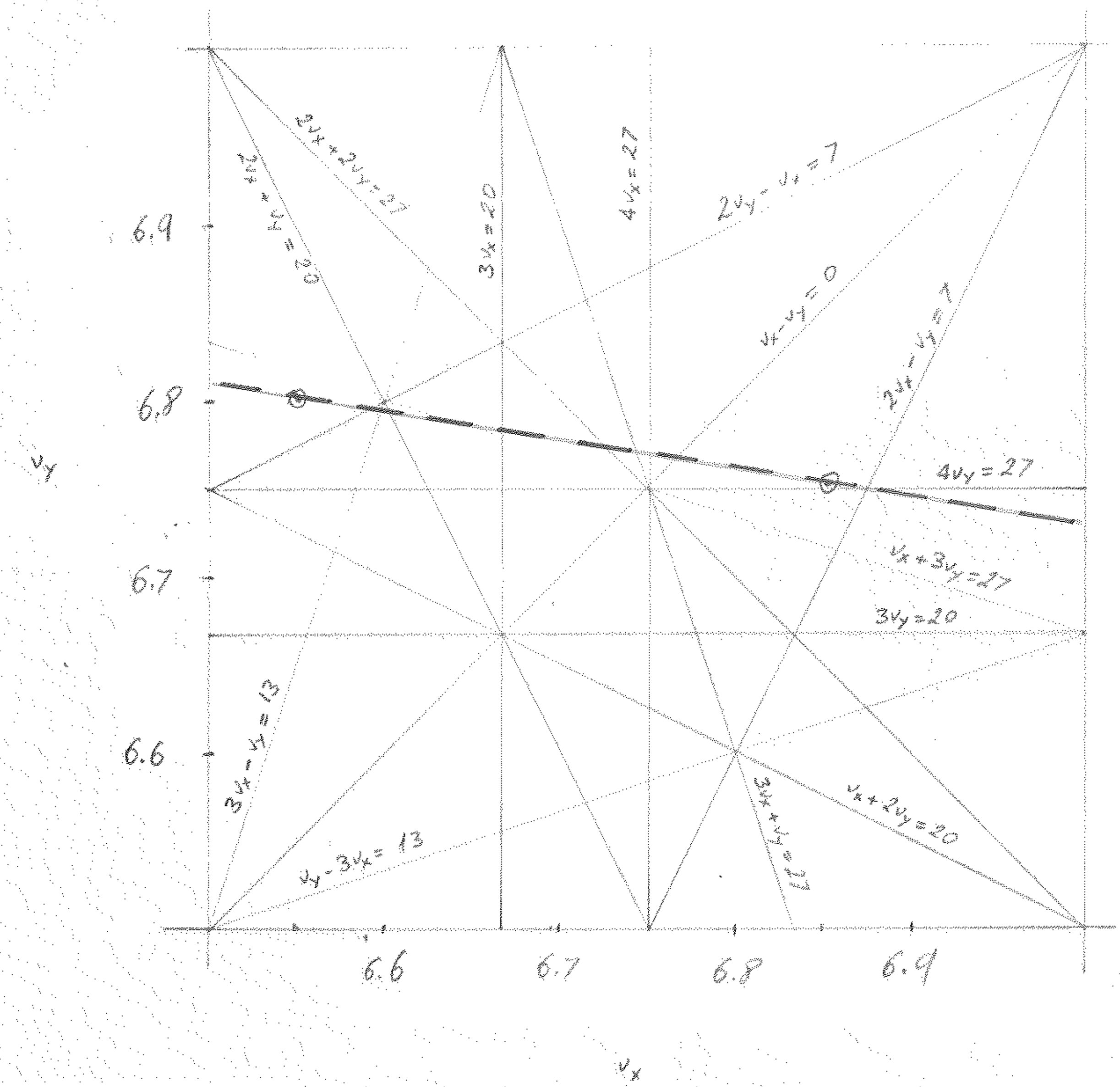
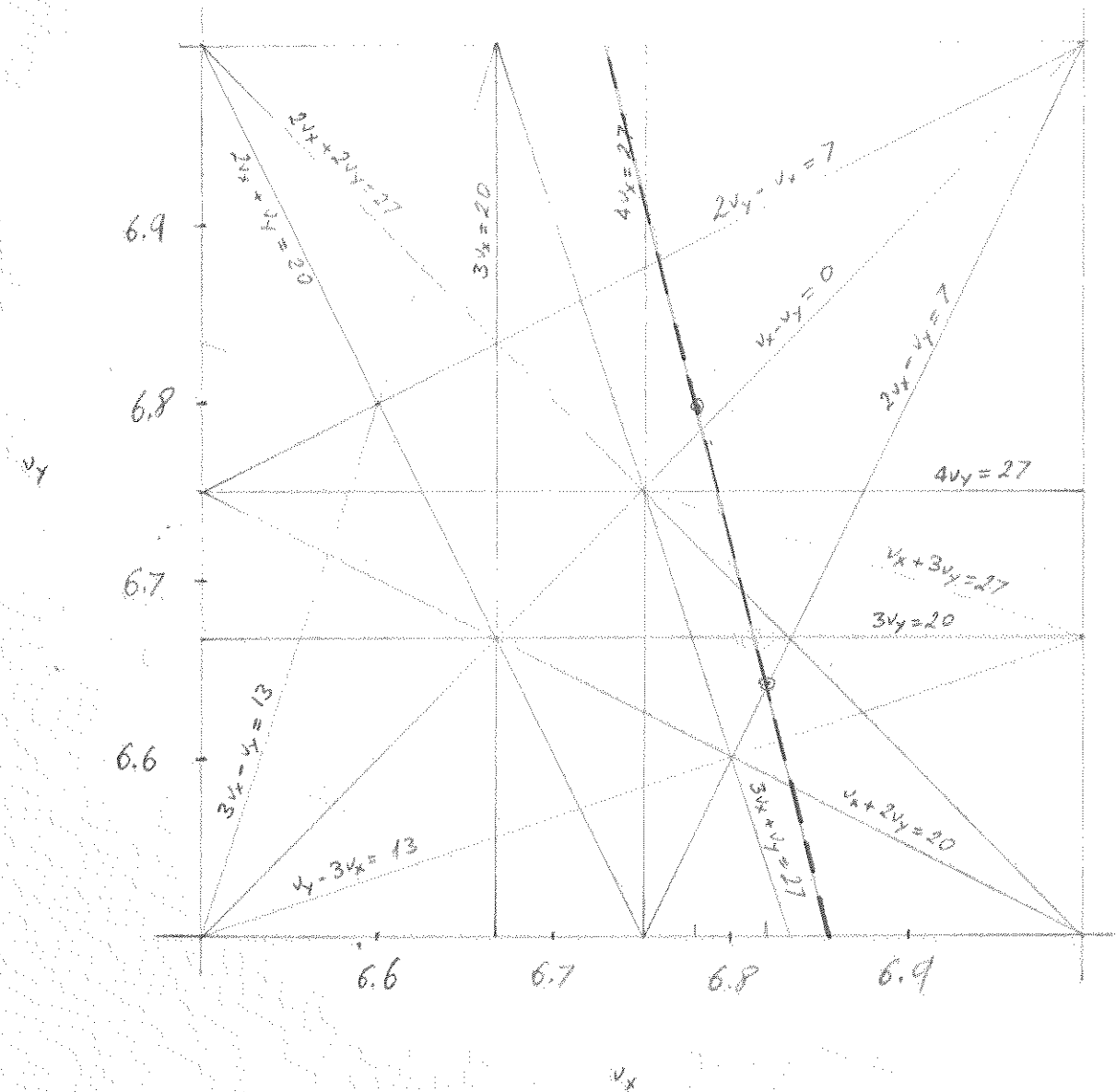
2vx + 2vy = 27
3vx = 20
4vx = 27
2vy - vx = 7
vx - vy = 0
2vx - vy = 7
4vy = 27
vx + 3vy = 27
3vy = 20
3vx - vy = 13
vx + 2vy = 20
3vx + vy = 27
vy - 3vx = 13
6.6
6.7
6.8
6.9
vy
vx

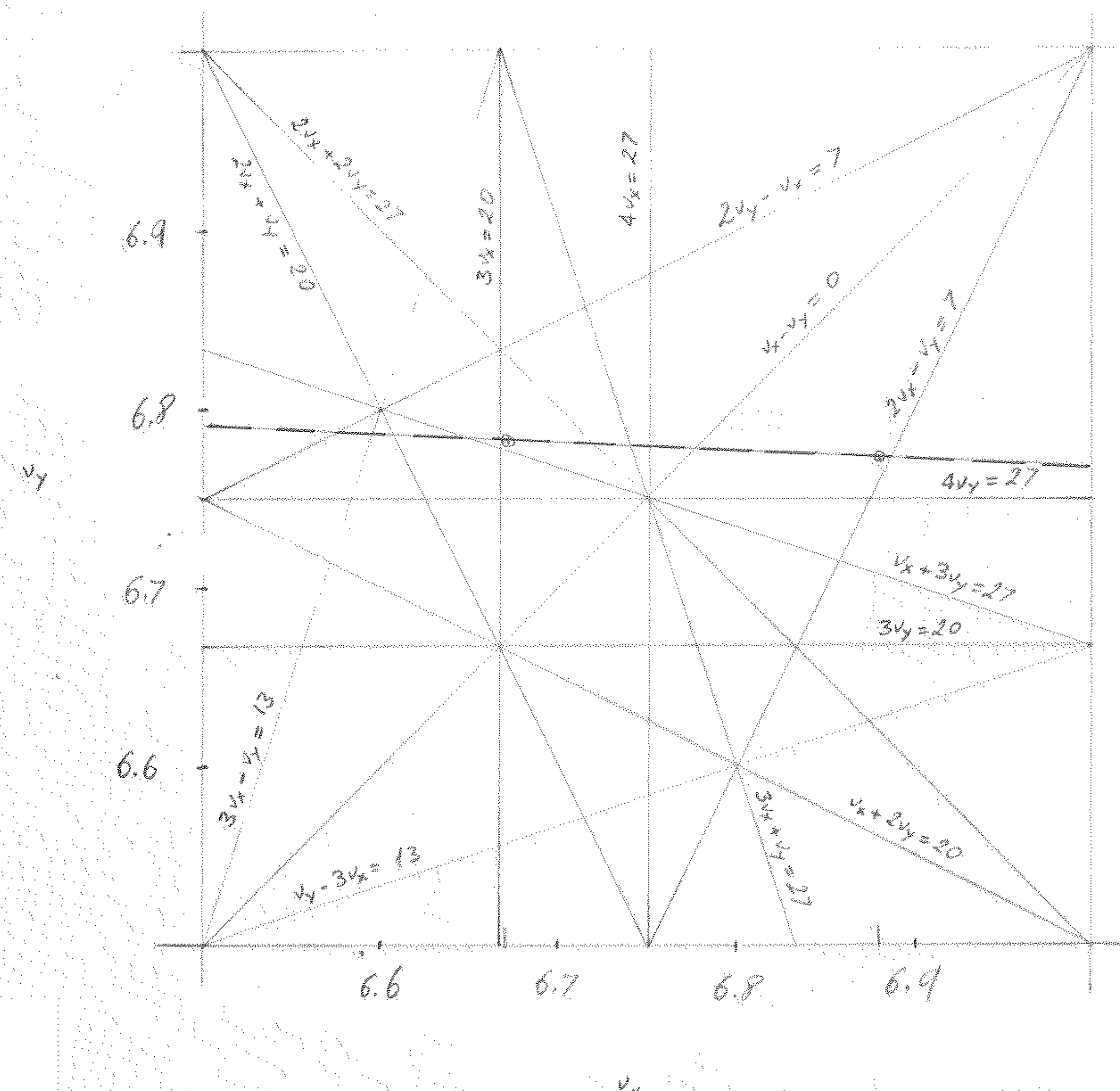
9 and 10


6.9
6.8
6.7
6.6
6.6
6.7
6.8
6.9
v_x
$2v_x + 2v_y = 27$
$2v_x + v_y = 23$
$3v_x = 20$
$4v_x = 27$
$2v_y - v_x = 7$
$v_x - v_y = 0$
$2v_x - v_y = 7$
$4v_y = 27$
$v_x + 3v_y = 27$
$3v_y = 20$
$3v_x - v_y = 13$
$v_x - 3v_x = 13$
$3v_x + v_y = 13$
$v_x + 2v_y = 20$


2vx + 2vy = 27
2vx + vy = 20
3vx = 20
4vx = 27
2vy - vx = 7
vx - vy = 0
2vx - vy = 7
4vy = 27
vx + 3vy = 27
3vy = 20
3vx - vy = 13
vy - 3vx = 13
3vx + vy = 27
vx + 2vy = 20
6.9
6.8
6.7
6.6
vy
6.6
6.7
6.8
6.9
vx


$2v_x + 2v_y = 27$
$2v_x + v_y = 20$
$3v_x = 20$
$4v_y = 27$
$2v_y - v_x = 7$
$v_x - v_y = 0$
$2v_x - v_y = 7$
$4v_y = 27$
$v_x + 3v_y = 27$
$3v_y = 20$
$3v_x - v_y = 13$
$v_y - 3v_x = 13$
$v_x + 2v_y = 20$
$3v_x + v_y = 27$
6.9
6.8
6.7
6.6
v_y
6.6
6.7
6.8
6.9
v_x

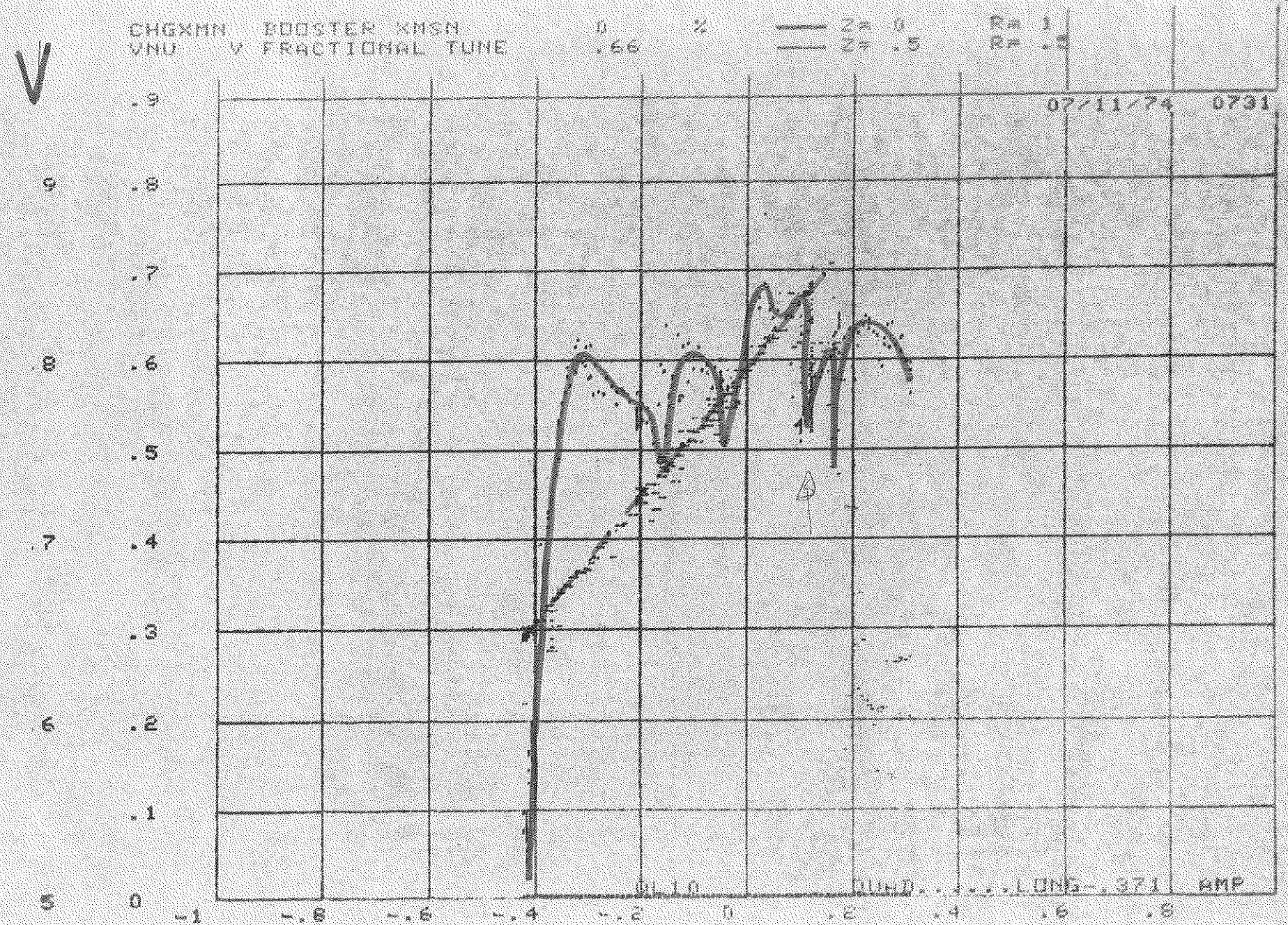
6.9
6.7
6.5
6.3
6.9
6.7
6.5
x_1
x_2
$4x_1 = 27$
$3x_1 = 20$
$4x_2 = 27$
$3x_1 + 2x_2 = 27$
$2x_1 + x_2 = 20$
$x_1 + 3x_2 = 27$
$x_1 + 2x_2 = 20$
$2x_1 - x_2 = 7$
$x_1 - x_2 = 0$
$x_1 - 2x_2 = -13$



$2v_x + 2v_y = 27$
$2v_x + v_y = 20$
$3v_x = 20$
$4v_x = 27$
$2v_y - v_x = 7$
$v_x - v_y = 0$
$2v_x - v_y = 7$
$4v_y = 27$
$v_x + 3v_y = 27$
$3v_y = 20$
$3v_x - v_y = 13$
$v_y - 3v_x = 13$
$3v_x + v_y = 27$
$v_x + 2v_y = 20$
6.9
6.8
6.7
6.6
v_y
6.6
6.7
6.8
6.9
v_x

.8 V .718 .775 .84

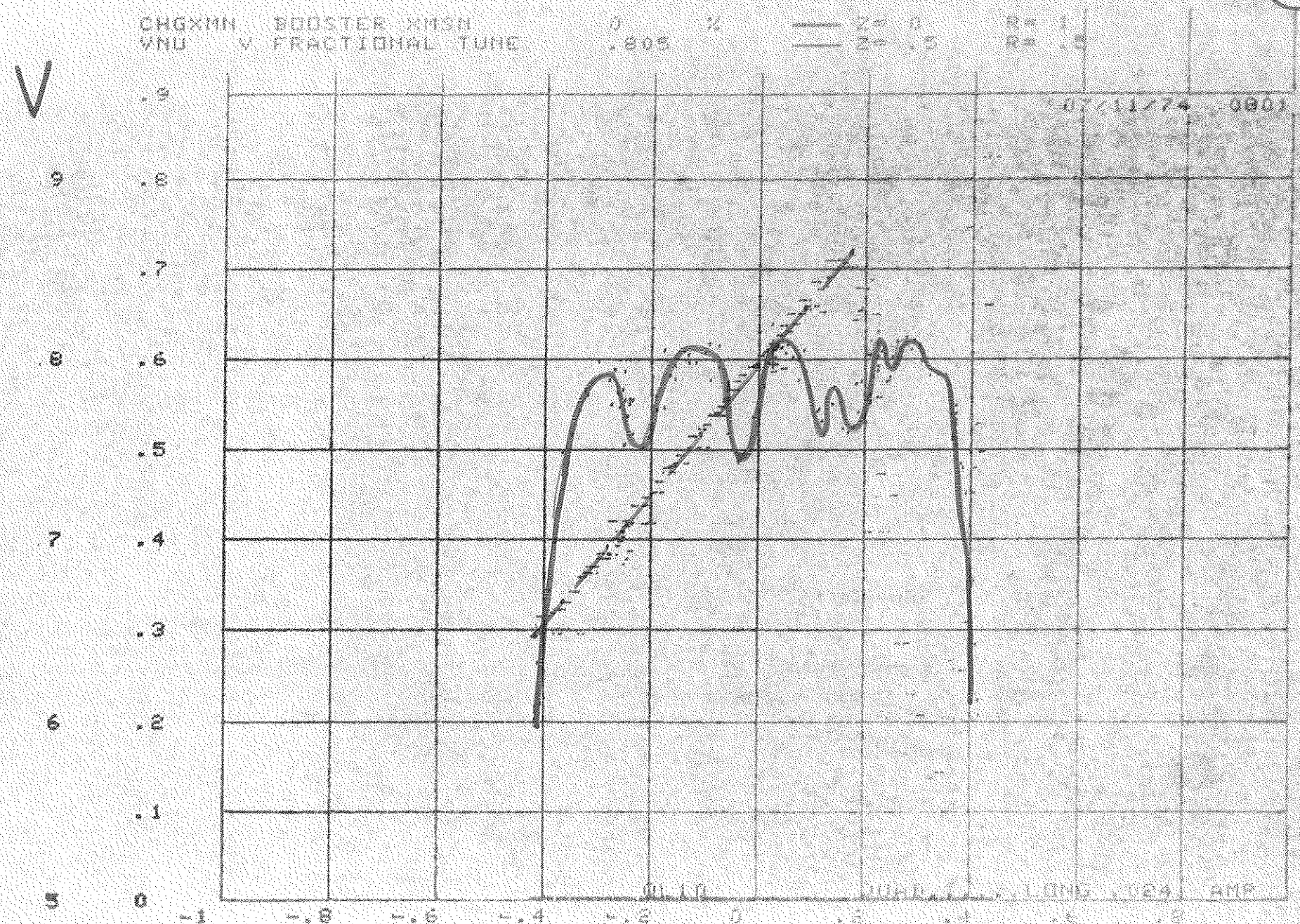
(2)



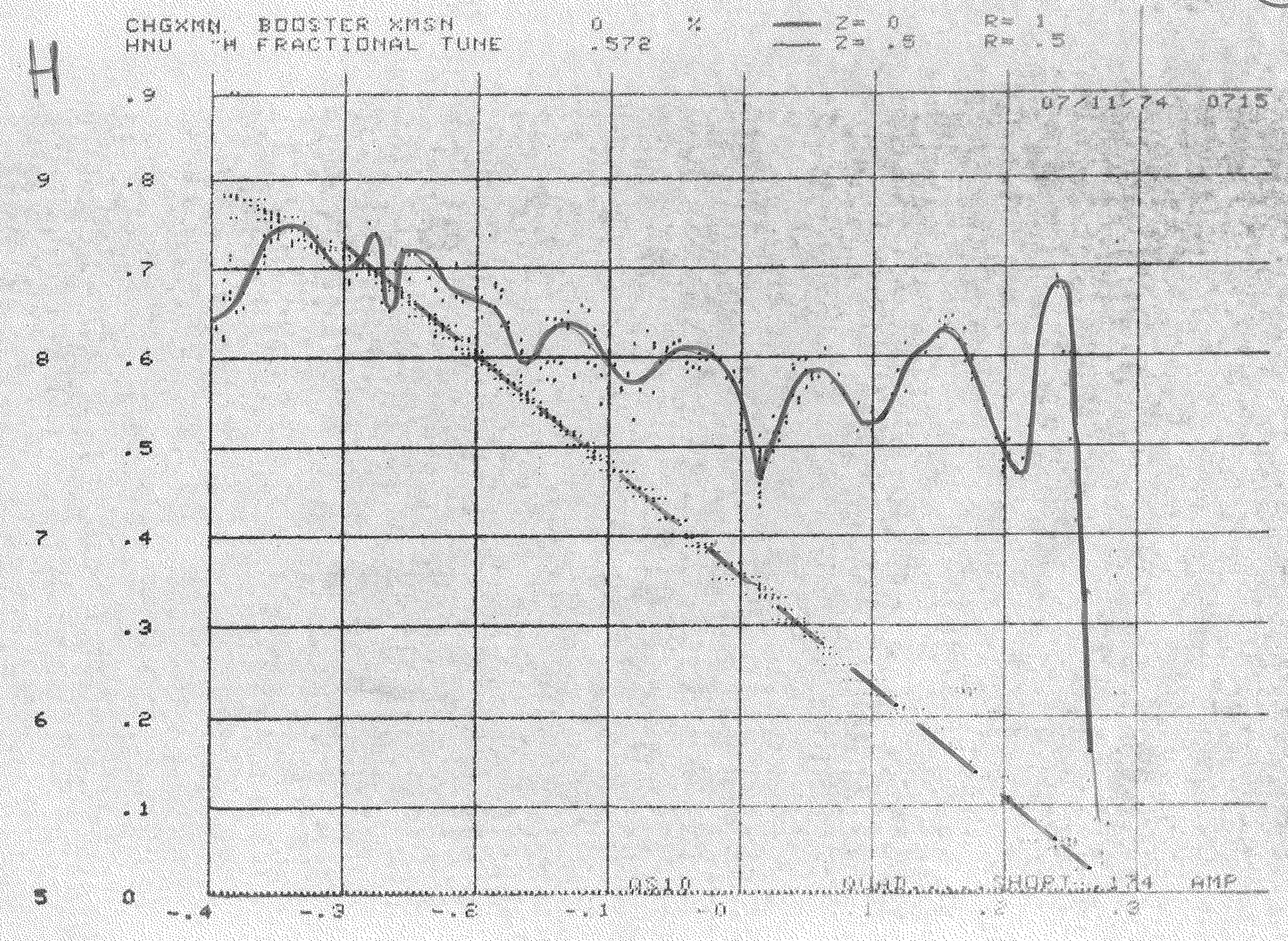
V

V wire in

(3)

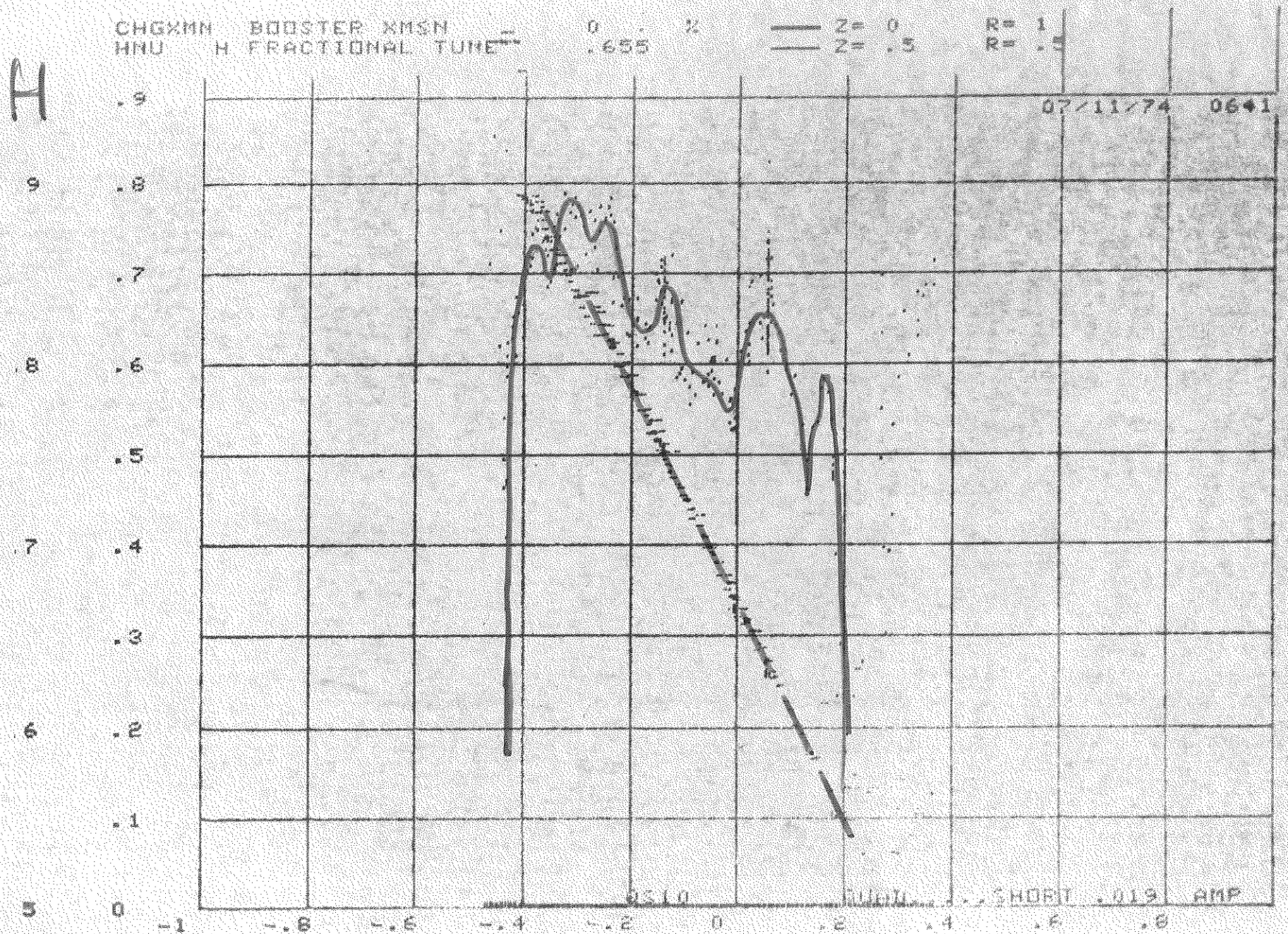

CHGXMIN BOOSTER MIGN 0 %
ΔNU V FRACTIONAL TUNE .805
Z= 0 R= 1
Z= .5 R= .5
07/11/74 0001
V
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
-1
-.8
-.6
-.4
-.2
0
.2
.4
.6
.8

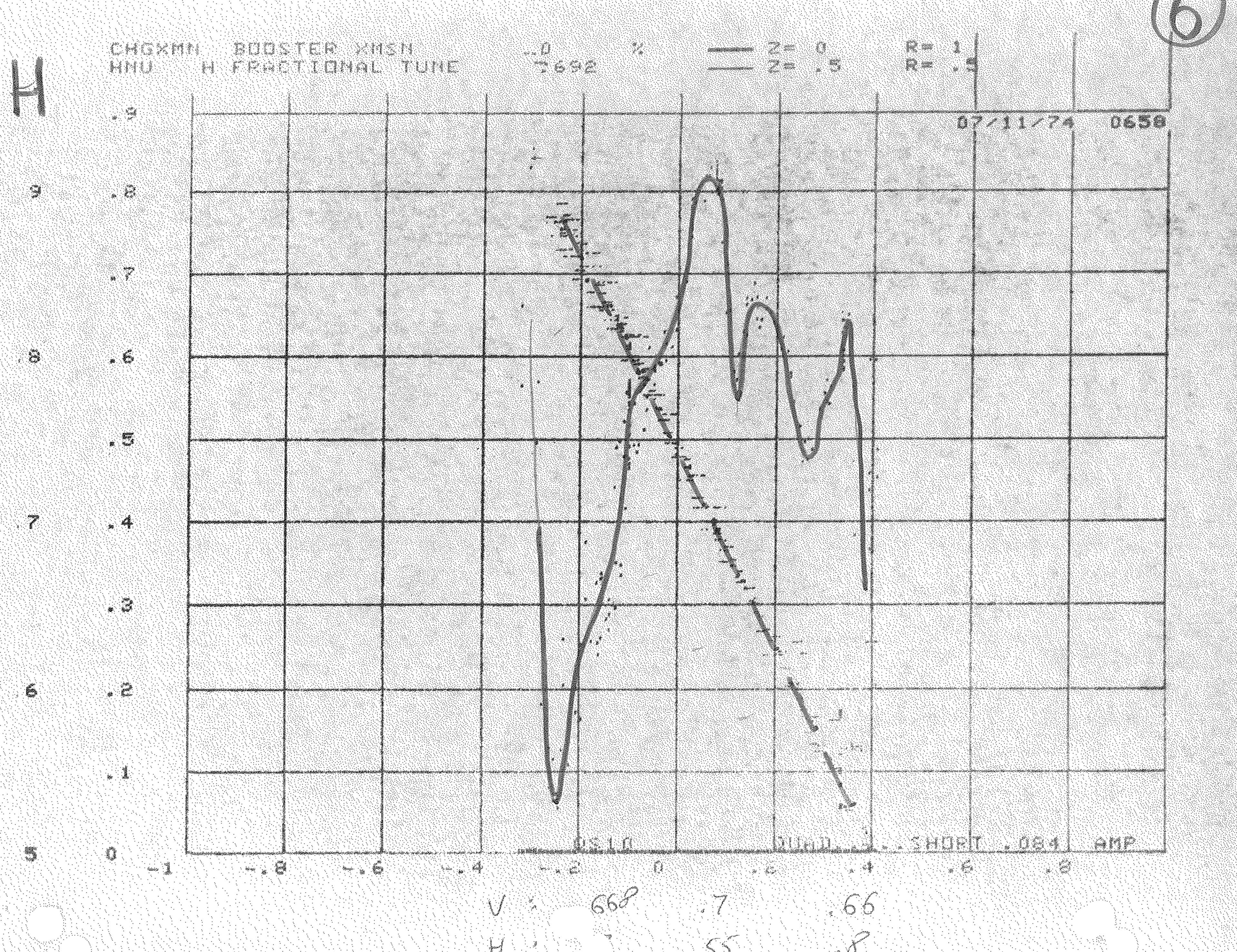
(4)

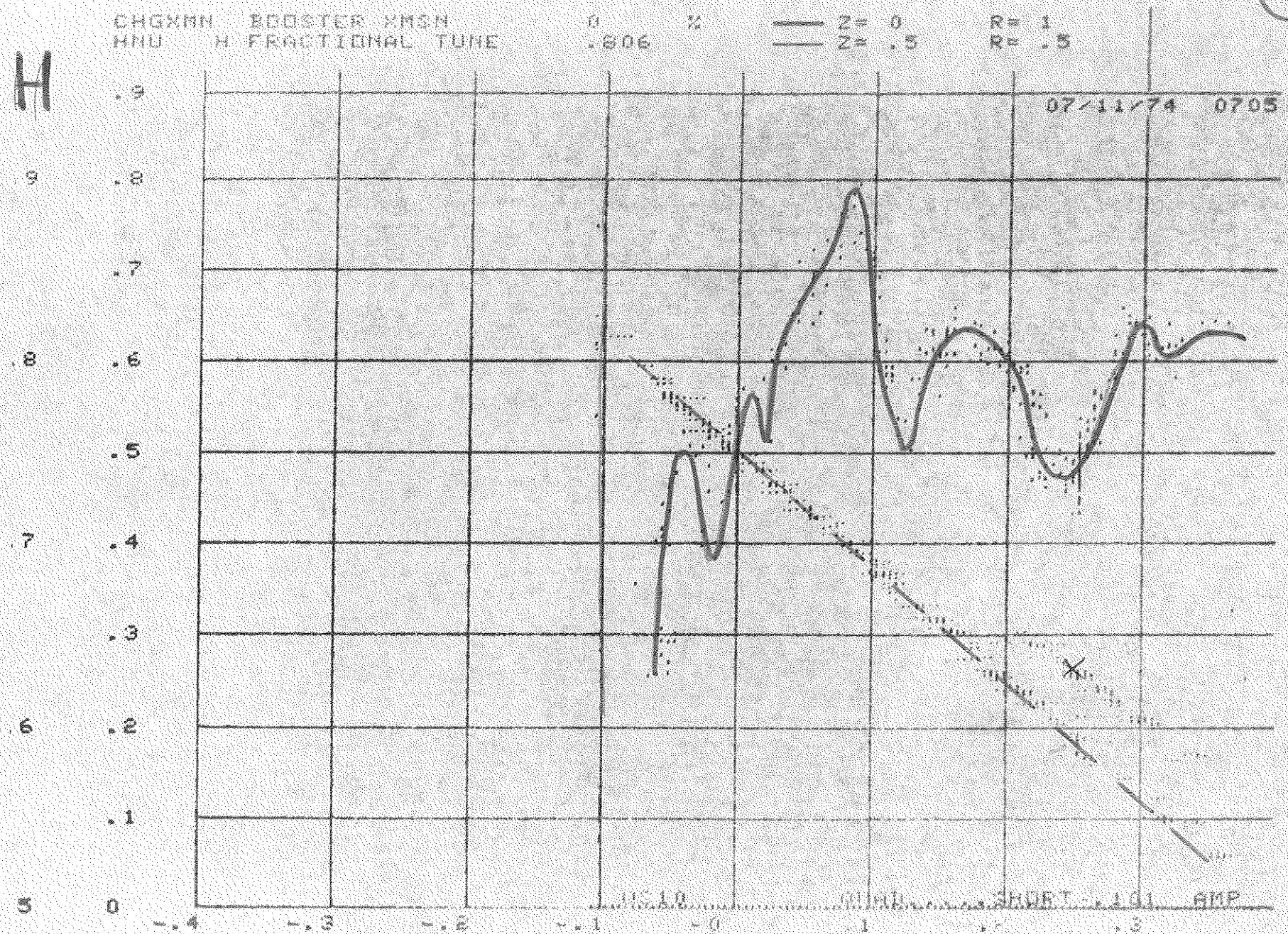

H
CHGXMN BOOSTER XMSN 0 %
HNU "H FRACTIONAL TUNE .572
Z= 0 R= 1
Z= .5 R= .5
07/11/74 0715
9
8
7
6
5
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
-.4
-.3
-.2
-.1
0
.1
.2
.3
QS10
QUAD
SHORT
1.34
AMP

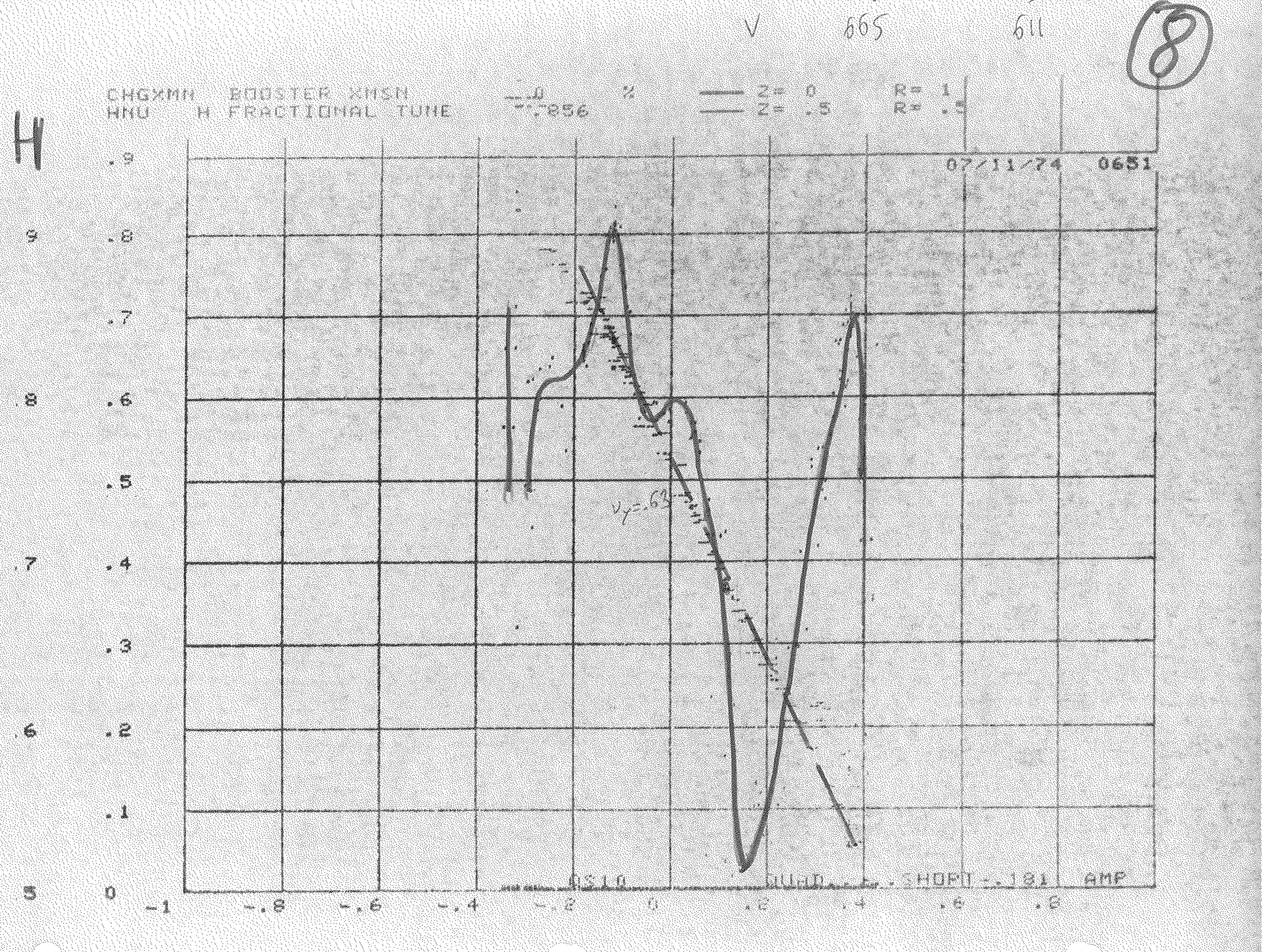
V .884 .875

(5)


CHGXMN BOOSTER XMSN = 0. %
HNU H FRACTIONAL TUNE = .655
Z= 0 R= 1
Z= .5 R= .5
07/11/74 0641
H
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
.9
.8
.7
.6
.5
-1
-.8
-.6
-.4
-.2
0
.2
.4
.6
.8
SHORT .013 AMP

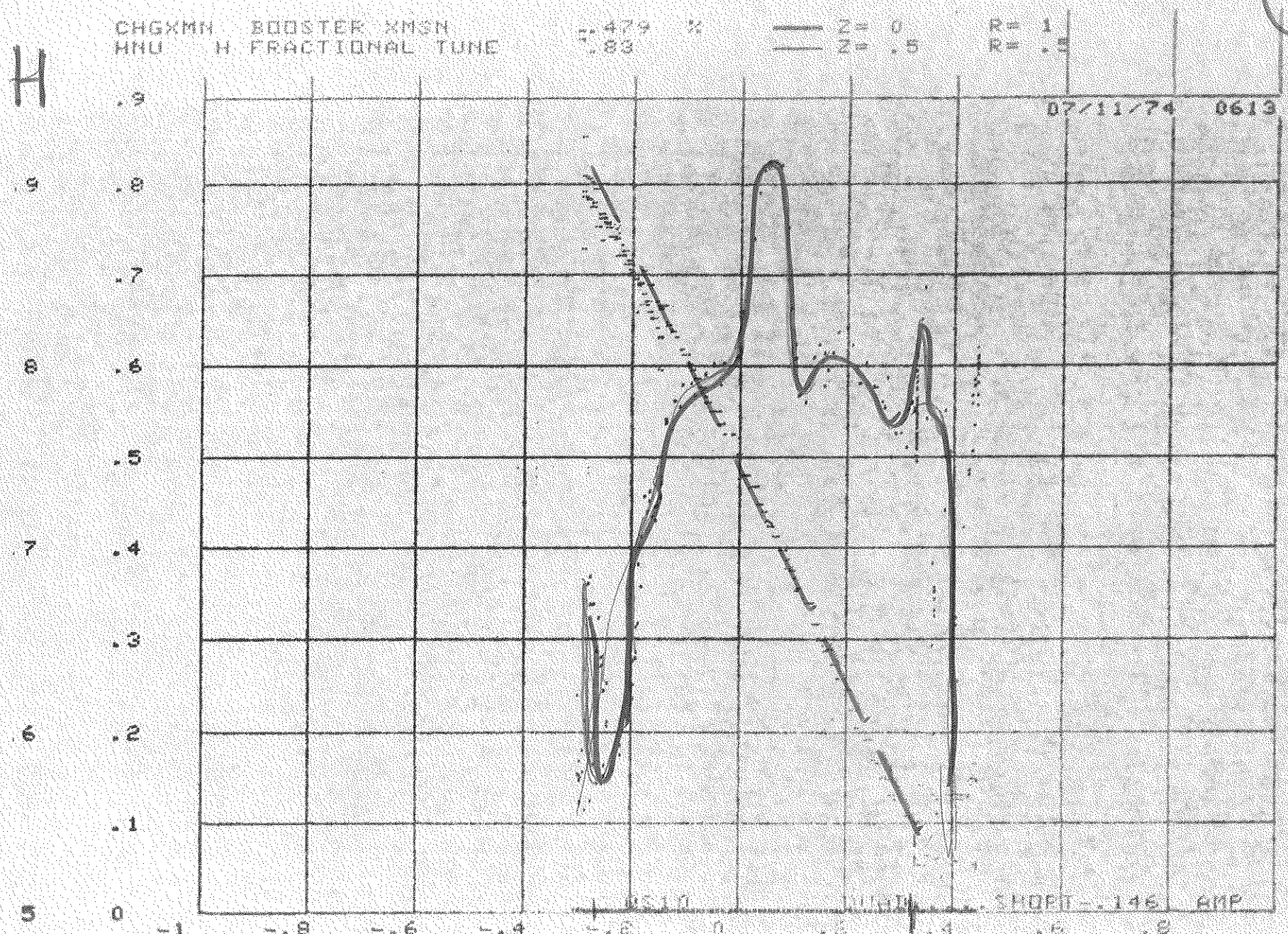

⑥
H
CHGXMN BOOSTER XMSN .0 %
HNU H FRACTIONAL TUNE .692
Z= 0 R= 1
Z= .5 R= .5
07/11/74 0658
.9
9 .8
.7
8 .6
.5
7 .4
.3
6 .2
.1
5 0
-1 -.8 -.6 -.4 -.2 0 .2 .4 .6 .8
DS10
QUAD SHORT .084 AMP
V: 668 .7 .66
H: .55 .8


CHGXMN BOOSTER XMSN 0 %
HNU H FRACTIONAL TUNE .806
Z= 0 R= 1
Z= .5 R= .5
07/11/74 0705
H
V .68
H .6
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
-.4
-.3
-.2
-.1
-0
.1
.2
.3



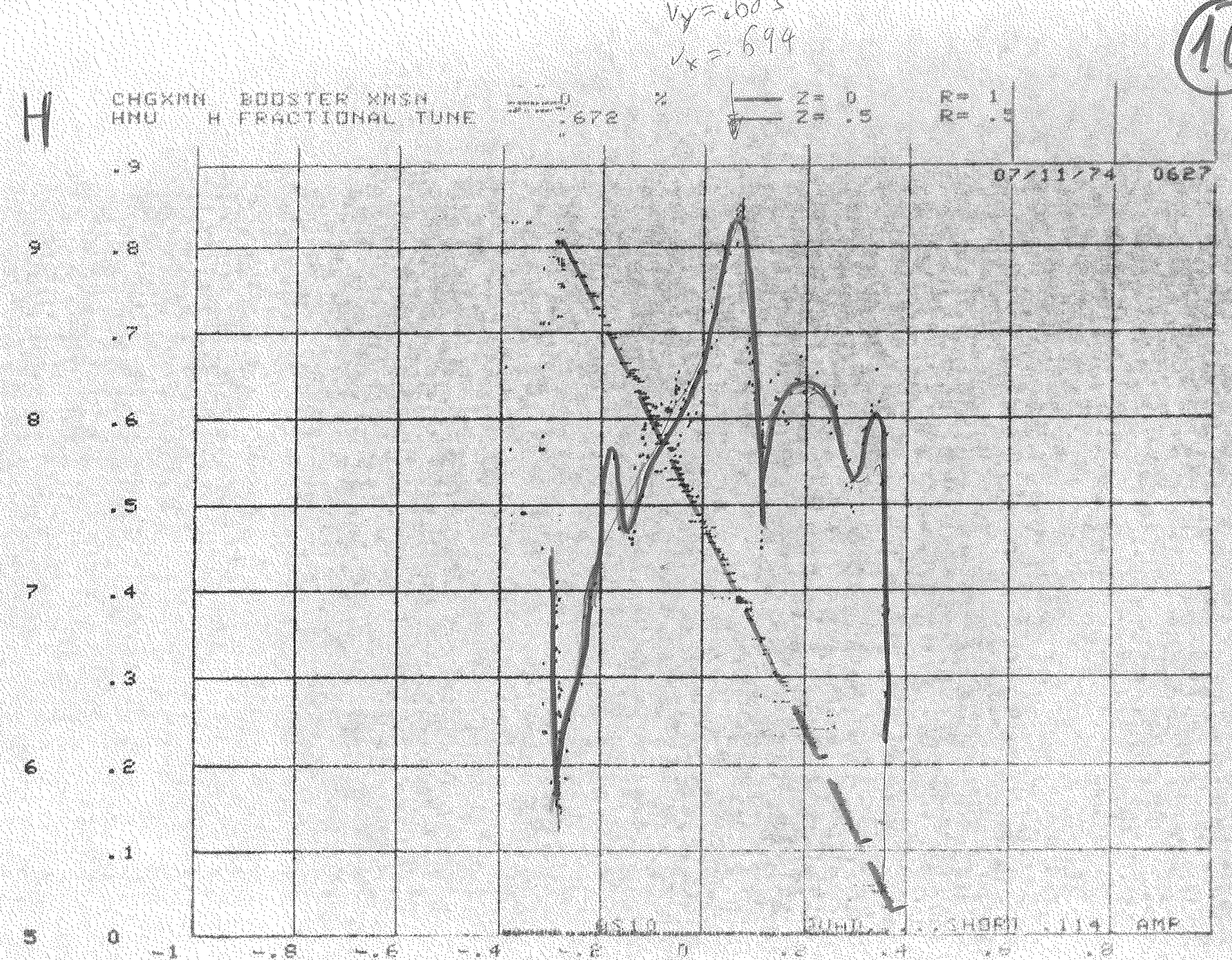
V 665 611
8
CHGXMN BOOSTER XMSN
HMU H FRACTIONAL TUNE
.0 %
.856
Z= 0 R= 1
Z= .5 R= .5
H
07/11/74 0651
$\nu_y = .63$
QS10
QUAD SHORT .181 AMP
.9 .8 .7 .6 .5 .4 .3 .2 .1 0
9 .8 .7 .6 5
-1 -.8 -.6 -.4 -.2 0 .2 .4 .6 .8

$\nu_x = .694$

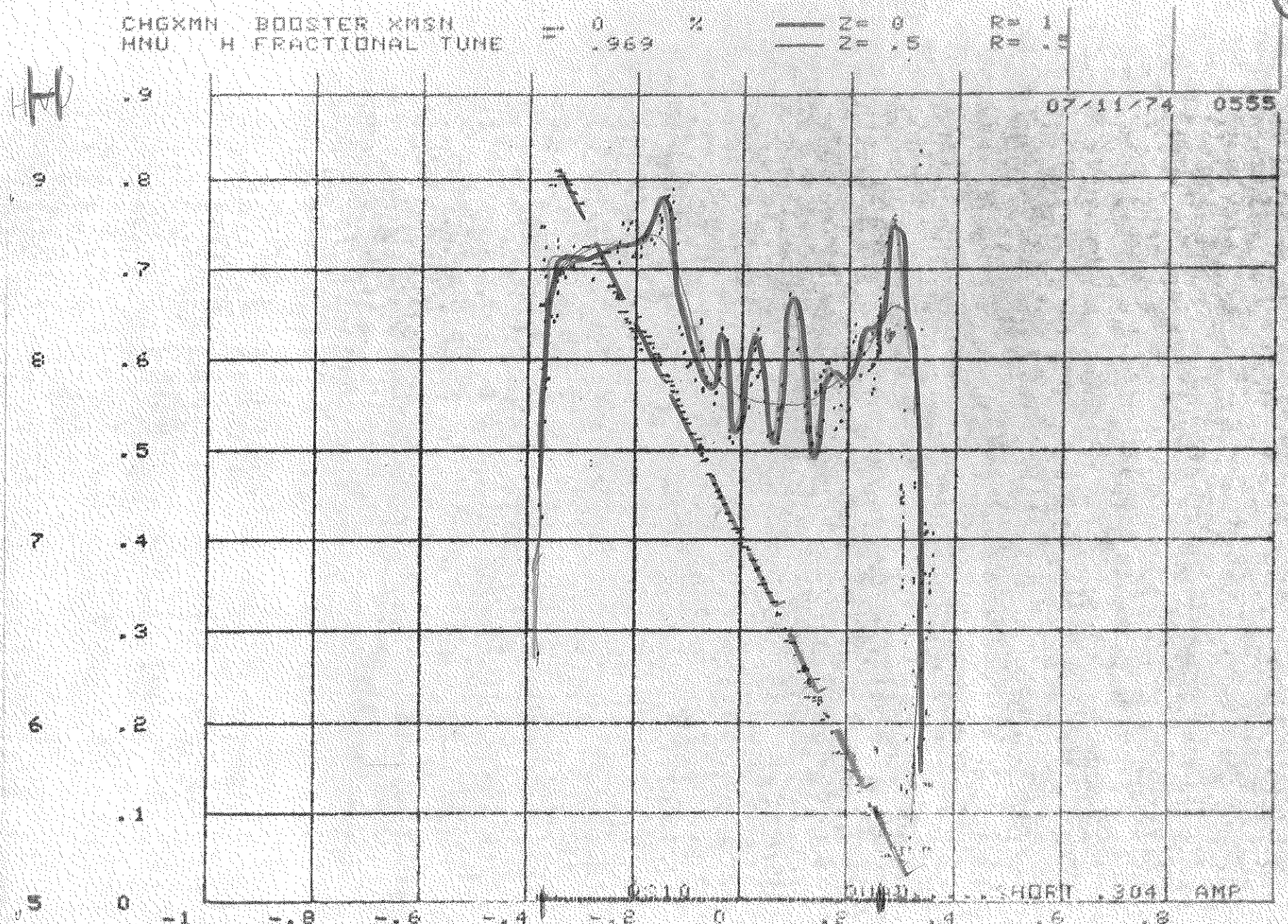


$\nu_y = .657$ at $\nu_x = .816$ .657

$= .71$ $= .53$



10
H
CHGXMN BOOSTER XMSN
HMU H FRACTIONAL TUNE
.672
Z= 0
Z= .5
R= 1
R= .5
07/11/74 0627
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
9
8
7
6
5
-1
-.8
-.6
-.4
-.2
0
.2
.4
.8
AMP



$\nu_y = .798$

.755

.798 ν_y

6.85

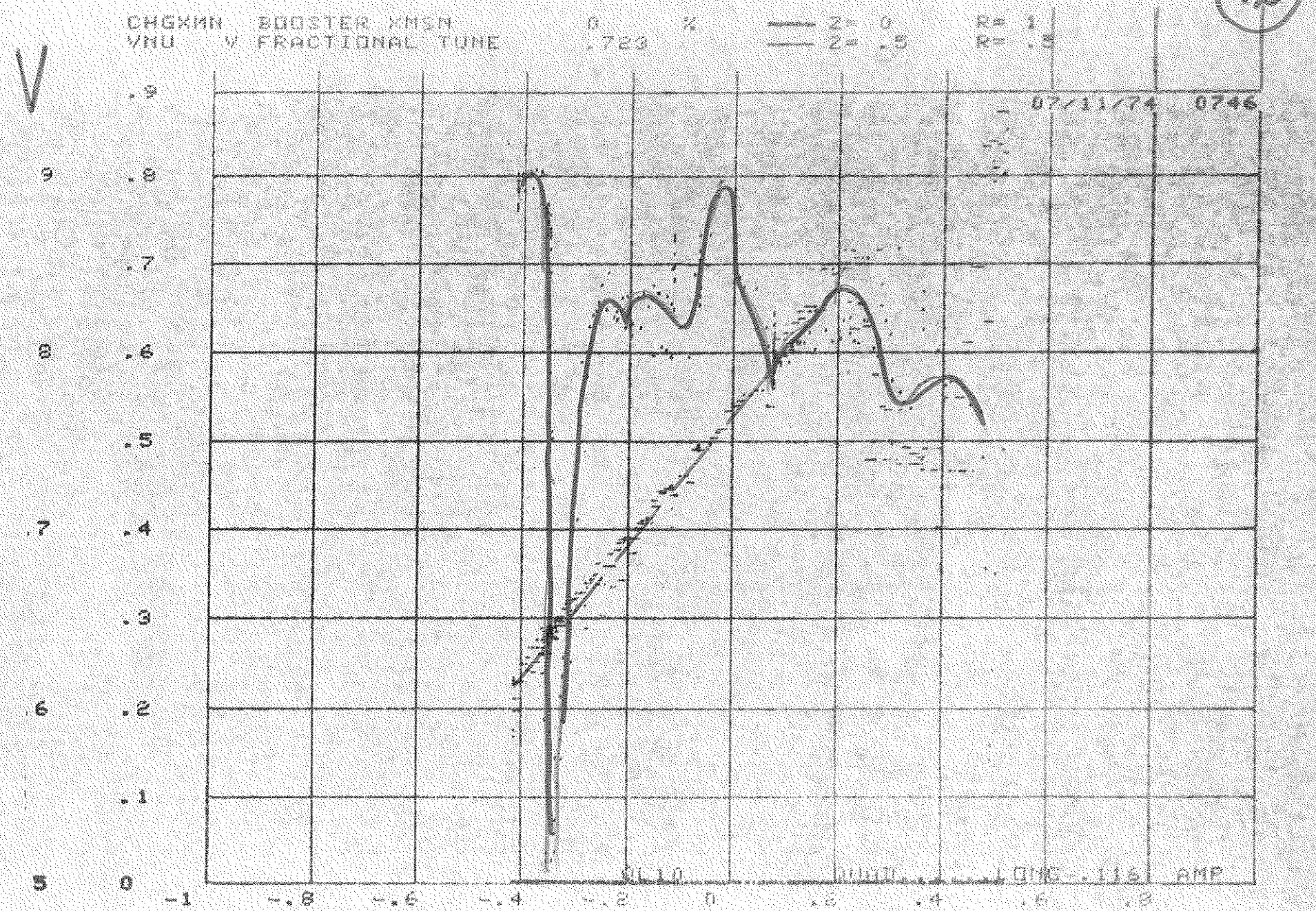
6.55 ν_x

ν_y

H .52 .78

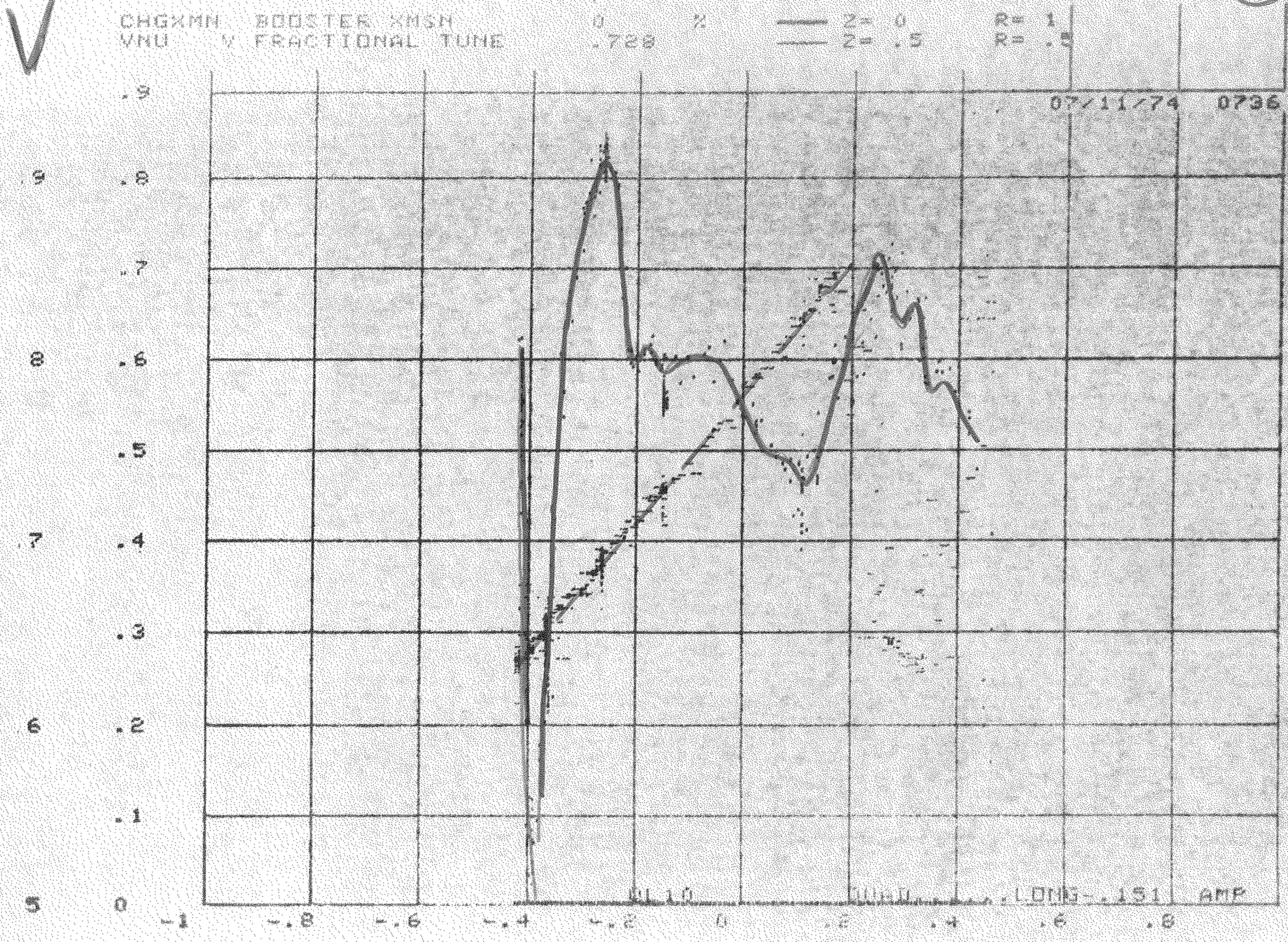
V .64 .795

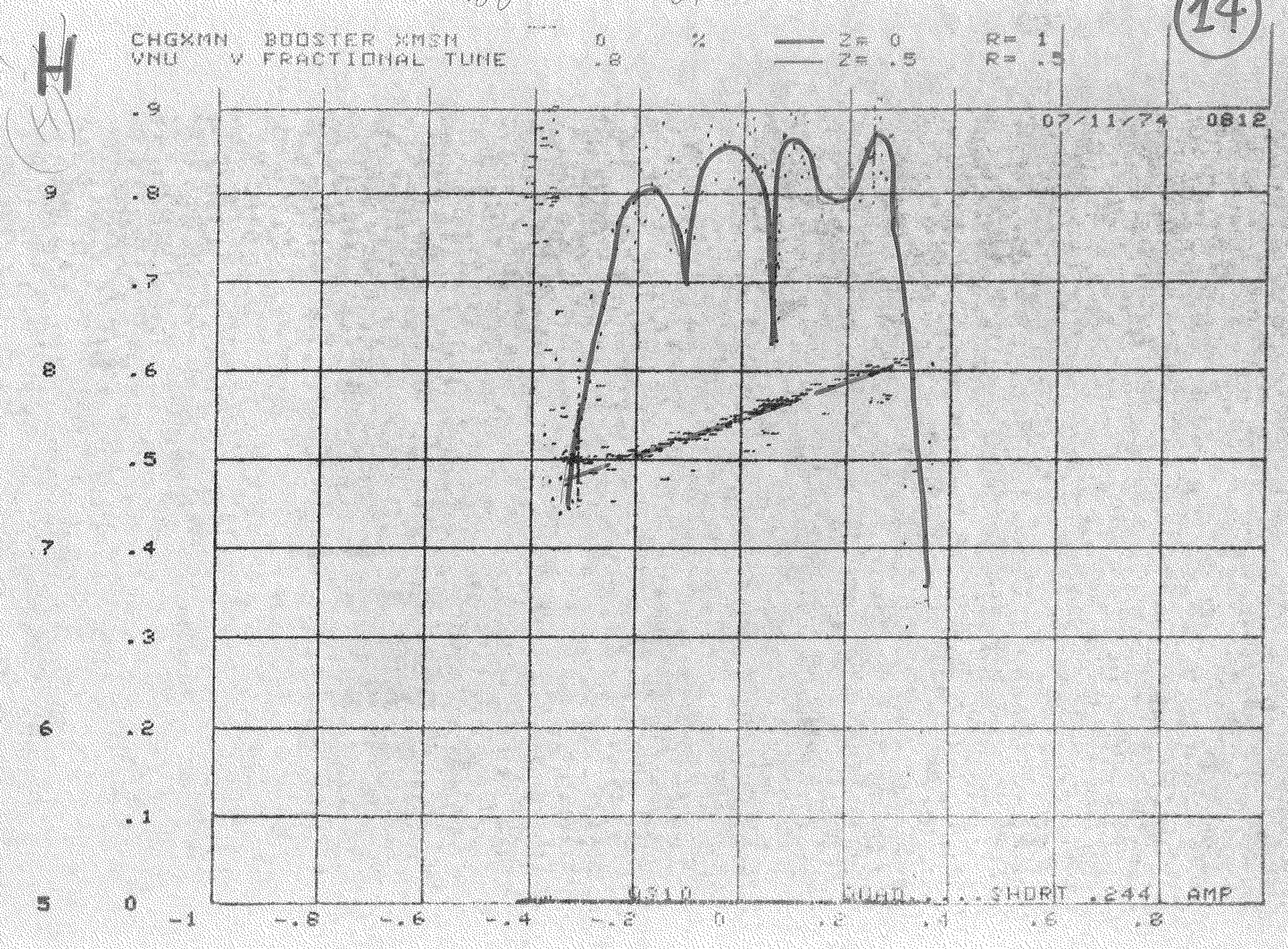
12

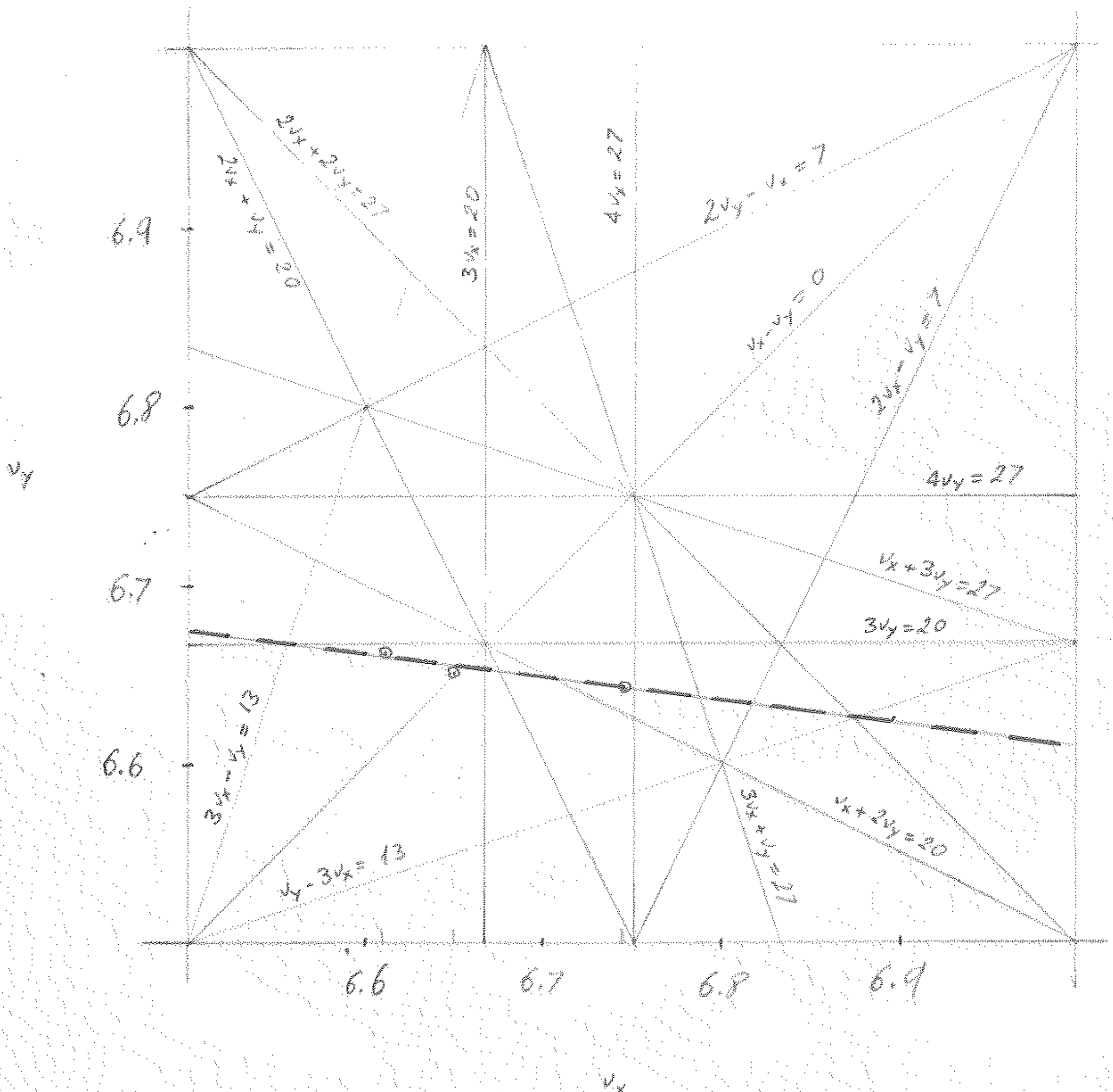


13

H .738 .72 .87 .83
V .64 .689 .82 .65




H
CHGXMN BOOSTER XMSM 0 %
VNU V FRACTIONAL TUNE .8
Z= 0 R= 1
Z= .5 R= .5
07/11/74 0812
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
9
8
7
6
5
-1
-.8
-.6
-.4
-.2
0
.2
.4
.6
.8
SHORT .244 AMP
.88
.67
14


2vx + 2vy = 27
2vx + vy = 20
3vx = 20
4vx = 27
2vy - vx = 7
vx - vy = 0
2vx - vy = 7
4vy = 27
vx + 3vy = 27
3vy = 20
3vx - vy = 13
3vx + vy = 21
vx + 2vy = 20
vy - 3vx = 13
6.9
6.8
6.7
6.6
vy
6.6
6.7
6.8
6.9
vx

H .745 .67 .65

V .64 .66 .65

(15)